Action fidelity

Annie Luciani, Thomas A. Stoffregen

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Annie Luciani [ACROE&INPG]
Thomas A. Stoffregen [HFRL]

Contributors: Benoit Bardy [UM1]

Speaking about action fidelity supposes to define two situations, to compare the actions undertaken in both of them to perform similar tasks or to reach similar goals: one that can be called a reference situation and one that can be called a represented situation, which is a new implementation of the first situation.

[Stoffregen et al., 2003] hence defines action fidelity in terms of relations between performance in a reference situation, called simulated system, and performance in a represented system, called simulator. Action fidelity exists then when performance in the simulator transfers back to behaviour in the simulated system. An appropriate measure of action fidelity is transfer of learning, or transfer of training. Action fidelity is measured in terms of task performance. Common metrics that could be used to compare performance in a simulator and in the simulated system are time to completion of a task, variance in performance across trials, and trials to criterion.

In tasks mediated by computerized technologies, the comparison is usually made between a task performed through instruments implemented in non-computerized technologies, mainly in mechanical technology, and similar tasks implemented by means of a computerized – or more generally electrified – instrument. For example, existing tools for non-invasive surgery used in real surgical performance, and virtual reality simulation platform to learn surgery practices. The first is then, more or less explicitly, considered as the reference situation, and the second as the situation that have to guaranty more or less a fidelity principle. In the enactive framework, and more generally in the ecological approaches of action and perception, the focal point for the comparison is put on the fidelity of action rather than in the fidelity of the perception.

Referring to the history of the techniques and the *techné* developed by humans to face up to the necessities of the human life, tools and instruments have always evolved according to the properties offered by novel technologies, as assumed anthropologists such as Leroy-Gouran [Leroy-Gourhan, 1964]. There is no a priori reference situation and it is not possible to define fidelity, neither in action nor in perception. More generally, there is no case in which humans developed radically new tools in reference to an existing one. The basic reason is that a new tool is developed to cross over a new expectation. According to their needs, humans are creating new instrument (a screwdriver, a flight, and of course also computer) when it is necessary to perform new tasks; for these new tools, no comparison with existing tools is interesting.

Fundamental questions are then: is it truly possible to compare instrumental manipulations implemented on different instruments, for example instruments built from a previous technology (for ex. mechanics) and from today's technology (for ex. electrified technologies)? And is it really necessary?

This point of view is particularly applicable in the cases of artistic creation, computer tools and Virtual Reality based tools, etc. These tools are new instruments that are designed to extend the existing instrumentarium. But there are not new only because they are added to what existed previously, as for example piano was new after the harpsichord. They are new also because they allow new functionalities that did not exist previously.

In the framework of the instrumental paradigm developed by [Cadoz et al., 1984] [Luciani, 1993], there is no need of action fidelity between playing a real violin and playing an Intel Xeon Violin, no more than we can talk about action fidelity between a Stradivarius and an anonymous violin. But what that has to be preserved is the "violin playing", i.e. the conformity of the instrument as being a violin. Thus, the question of action (or perception) fidelity shifts to the conformity of the instrumental interaction, i.e. what are the minimal sensori-motor and cognitive conditions that an instrument – such as those including virtual objects - must guaranty to perform a task.

In other words, in the design of new instruments, the question is shifted from: "what are the conditions that will guaranty action fidelity" to "what are the minimal interaction properties (in action and perception) guarantying that, for example, a virtual violin, will be played as a violin". In other words, the question to ask is: what is a violin and what does the modelling process of the violin has to take into account in order to build a computerized violin?

Thus, the question of the fidelity (in action and/or in perceptions) is shifted to the design of the new instrument (analysis, modelling, validation), starting from a causal level, with epistemic observation of what are the relevant invariant features able to define an instrumental violin, able to guaranty the conformity of the computer violin to the category violin.

Alternative concepts to action fidelity are those of: playability [O'Modhrain et al., 2000], Usability [→ Usability], believability of the instrument [→ Believability_ 1&2], goal or task-based design, etc…

To conclude, in the design and use of new tools and instruments, at the theoretical level, action fidelity - and its mirror technological concept of transparency [→ Transparency_2] has to be considered as a limit concept. At the pragmatic level, it relates more to transitory situations, whether when testing technology, whether during which there is no novel practices that have yet emerged. Further, in the development of new practices, the question of the learning of manual tasks by using simulators is an open issue, not yet solved, which still requires great efforts for evaluating the transfer between simulated situations (learning on simulator) and the situation in the real practices, and vice-versa. This corresponds to lively research in the field of technology enhanced learning, and a major centre of interest in enactive interfaces, related to the use of enactive systems in learning manual tasks.

References

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Related items

Believability_1
Believability_2
Transparency_2
Usability